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# A Comprehensive Study on the Benefits of Education and Home-Based Follow-Up on Diabetes Awareness and Behavior Modifications in Baghdad Teaching Hospital, Iraq

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**Quantitative Study**

## Abstract

**Background:** This study, conducted at Baghdad Teaching Hospital, Iraq, aimed to investigate the impact of education and home-based follow-up on diabetes awareness and behavior modifications among Type 2 Diabetes Mellitus (T2DM) patients. Given the high prevalence and mortality rate of diabetes in Iraq, this research addresses a critical public health issue by exploring effective management strategies for one of the country's leading causes of death.

**Methods:** We employed a semi-experimental, two-group design with pretest and posttest assessments. The study was conducted in 2023 in Baghdad, Iraq. Using the hospital's records and through direct involvement at the diabetes and endocrinology treatment center, 60 T2DM patients were selected. Participants, aged between 30 and 80 years with an HbA1c level of greater than 9%, were randomly assigned to either an intervention or a control group. The intervention group underwent four 1-hour training sessions and received 3 monthly home visits. Data were collected using a researcher-made questionnaire and analyzed employing chi-square test, t-test, and ANOVA in SPSS software.

**Results:** Post-intervention, significant improvements were observed in the intervention group in terms of diabetes awareness and health behaviors, with F and P values demonstrating these changes. For example, walking frequency improved (F = 58.45;

P = 0.001), and better adherence to dietary guidelines was noted (F = 26.47; P = 0.004). These results contrast with less pronounced changes in the control group, indicating the effectiveness of the educational intervention and home follow-up.

**Conclusion:** The findings confirm the effectiveness of Hospital-based education with home follow-up and follow-up in enhancing diabetes awareness and self-management behaviors in T2DM patients. This approach led to significant improvements in health behaviors and diabetes awareness, with potential economic benefits. Future research should explore the scalability and sustainability of these interventions in different settings.

**Keywords:** Diabetes mellitus; Patient education as topic; Health knowledge; Attitudes; Practice

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## Introduction

Diabetes is a major public health concern globally, significantly impacting mortality and morbidity rates. It is a leading cause of various complications, including heart disease, stroke, kidney failure, blindness, and lower limb amputation, thereby severely affecting quality of life (QOL) and increasing healthcare costs (Mutlu et al., 2014; Naghibzadeh, Johari Fard, & Morad, 2018; Standl, Khunti, Hansen, & Schnell, 2019).

In Iraq, this chronic condition is a major cause of death, accounting for a substantial 48% of all fatalities. The incidence rate of diabetes in the country is notably high, with 212.7 cases per 100000 individuals. Approximately 417 individuals lose their lives each day due to complications associated with diabetes. This translates to an alarming annual death toll of around 152,000 people (Abusaib et al., 2020; Marzoq, Shiaa, Zaboon, Baghlany, & Alabbood, 2019). This disease poses a substantial burden on the healthcare system, emphasizing the need for effective management and prevention strategies to mitigate its impact on the population's health (Odhaib et al., 2022; Molavi, Afshar-Zanjani, & Hajializadeh, 2023).

For patients with diabetes, the disease often brings a myriad of challenges that significantly impact their QOL (Alreda, Mohameed, Al-Hili, Jawad, & Khamees, 2023). These individuals commonly experience physical symptoms such as fluctuating blood sugar levels, fatigue, and potential complications like neuropathy, which can lead to discomfort and pain. Their daily activities may be limited, and they often face difficulties in adapting to the lifestyle changes required for managing the condition (Mayeda et al., 2020; Rosenberger, Blechschmidt, Timmerman, Wolff, & Treede, 2020).

Psychologically, diabetes can be a heavy burden. Patients frequently contend with anxiety and depression due to the chronic nature of the disease and the constant vigilance required for its management (Alreda et al., 2023). The fear of potential complications, like vision loss or kidney failure, adds to this psychological stress (Swanson & Maltinsky, 2019).

Socially and economically, diabetes can be disruptive (Patel, 2020). The need for regular medical care and dietary restrictions can strain interpersonal relationships and family dynamics. Patients may also experience a loss of job security or reduced participation in recreational activities, contributing to an overall decrease in life satisfaction (Hill-Briggs et al., 2021). The chronic and unpredictable nature of diabetes often leads to an uncertain future, exacerbating the emotional and psychological challenges associated with the disease (Power et al., 2020).

With the technological advancements in the diagnosis and treatment of diabetes, the duration of hospitalization for patients has significantly decreased. As a result, patients, especially those with complex treatment regimens, are often discharged earlier than before (Agarwal, Schechter, Southern, Crandall, & Tomer, 2020). This early discharge can be a source of stress for diabetes patients, as the limited time spent in the hospital may not provide them with sufficient opportunities to learn and understand how to manage their condition effectively (Akalu & Belsti, 2020).

Upon returning home, these patients face the challenge of managing their diabetes, including monitoring blood sugar levels, adhering to medication schedules, and maintaining appropriate diets, without the immediate support and guidance of hospital staff (Hermann, Heimro, Haugstvedt, Hernar, Sigurdardottir, & Graue, 2021; Janssen et al., 2020). In such situations, one of the most critical needs for these patients is access to comprehensive and easily understandable information about their condition. Proper education regarding their disease management is essential;

without a clear understanding of their treatment recommendations, patients may find it difficult to follow them correctly (Pranata et al., 2022). Ensuring that diabetes patients receive the necessary information and support during their shortened hospital stays is crucial for their ability to manage their condition effectively at home, thus reducing the risk of complications and potential readmissions (Bae et al., 2022).

Patient education is a crucial aspect of diabetes management, both during hospitalization and in the community setting (Hasan et al., 2023). While initial education is often provided in the hospital, patients may gradually forget this information after being discharged. Therefore, reinforcing and expanding upon this education is necessary for effective long-term management of the condition (Leong, Lee, Chien, Kuo, Kuo, & Chen, 2022; Sng, Tung, Lim, & Bee, 2023). Educating and following up with diabetes patients at home is particularly beneficial for those with chronic conditions. At home, patients can dedicate more time and attention to learning about their disease management. Additionally, after the acute phase of their condition has passed, they are often in a better mental and emotional state to understand and absorb educational materials (Higgins et al., 2022).

Home-based patient education also allows health service providers, especially nurses, to deliver information directly and interact face-to-face with the patient (Chow, Hassali, Saleem, & Aljadhey, 2016). This personalized approach provides an opportunity for patients to discuss their concerns, ask questions, and express their needs more freely. Tailoring the education to address individual patient circumstances and challenges can significantly enhance the effectiveness of diabetes management and help patients lead healthier, more informed lives (Shah et al., 2015). Various studies have highlighted the significant role of patient education in improving the management of chronic diseases and enhancing patient engagement (Jarvis, Skinner, Carey, & Davies, 2010; Coppola, Sasso, Bagnasco, Giustina, & Gazzaruso, 2016; Lambrinou, Hansen, & Beulens, 2019). These studies consistently affirm the positive impact of education across multiple dimensions. One notable area is the economic value of patient education. Research indicates that, on average, every dollar invested in patient education can result in savings of 10 to 20 dollars in treatment, care, and rehabilitation costs (Navarro-Flores & Cauli, 2020). This demonstrates not only the effectiveness of patient education in improving health outcomes, but also its potential to reduce healthcare expenditures significantly. However, there has been less discussion about the impact of education, particularly home-based follow-up, on behaviors related to the management of chronic conditions like diabetes. In light of this, researchers decided to undertake a study aimed at determining the effectiveness of both theoretical and practical education, along with its follow-up at home, on improving awareness and health behaviors related to the management of diabetes.

This study focused on a group of patients grappling with diabetes, aiming to ascertain how home-based education and follow-up can influence their treatment and overall health management practices. This research could provide valuable insights into the benefits of extending patient education beyond the hospital setting and into the home, potentially leading to more effective management of chronic conditions like diabetes.

## Methods

*Study design and participants:* The present study employed a semi-experimental design, utilizing a two-group approach with intervention and control groups, and

incorporated pretest and posttest assessments. The study participants comprised individuals diagnosed with type 2 diabetes mellitus (T2DM) for over a year, aged between 30 and 80 years, and exhibited an HbA1c level greater than 9% in the last test conducted within 12 months before joining the study. All participants had stable antidiabetic treatment in the preceding 3 months.

**Inclusion Criteria**

- Diagnosis of T2DM for more than one year
- Age range of 30 to 80 years
- HbA1c level greater than 9% in the last test performed within the past year
- No changes in antidiabetic treatment in the previous 3 months

**Exclusion Criteria**

- Presence of physical mobility diseases
- Receiving home health services
- Known psychological disorders or mental illnesses
- Inconsistent treatment regimen without supervision of an endocrinologist

*Sample selection:* A total of 60 individuals were selected for this study. The sampling method involved reviewing the diabetes care unit records at the Baghdad Teaching Hospital, Baghdad, Iraq, over a period of 5 months. This process was complemented by the researcher's direct involvement in the diabetes and endocrinology treatment center at the hospital. The participants were identified through these records and subsequent home visits. After obtaining informed consent, these individuals were randomly assigned to either the control or the intervention group. The sample size was determined based on similar previous studies (Coppola et al., 2016), taking into account the expected effect size, power, and dropout rate.

The study spanned a period of 5 months for participant selection and grouping, followed by a structured intervention phase. The total duration, including pretest, intervention, and posttest phases, and follow-up assessments, was 9 months.

*Instruments and variable:* The primary tool for data collection in this study was a researcher-developed questionnaire. This questionnaire comprised 2 sections: the first gathered demographic information of the patients, while the second assessed their awareness about diabetes, its risk factors, and included a checklist to monitor health behaviors pertinent to home management of the disease.

The initial version of the questionnaire was formulated based on extensive literature review and credible sources, tailored to the study's population context. To ensure its scientific validity, the questionnaire underwent a content validity process, involving reviews and revisions by a panel of 10 faculty members of the University of Baghdad, Hawler Medical University, Al-Nahrain University, University of Basrah, and University of Mosul, Iraq. The reliability of the questionnaire was determined using the test-retest method. Administered twice to a separate group of 20 individuals with a 15-day interval, the tool's consistency was evaluated. The knowledge measurement aspect of the questionnaire demonstrated a high level of reliability, evidenced by a correlation coefficient of 86% between the two sets of scores.

An exploratory factor analysis (EFA) was conducted. This statistical method is crucial for validating the questionnaire structure, particularly when the tool is researcher-made and tailored to a specific context (Jarvis et al., 2010). The EFA involved analyzing responses from a preliminary sample, distinct from the main study participants, to identify underlying structures within the questionnaire. Factors were extracted based on eigenvalues greater than 1.0, and a varimax rotation was

applied to maximize factor loadings. This process enabled the identification of distinct components within the questionnaire, ensuring that each item aligns with the intended construct.

The outcomes of the EFA demonstrated a clear factor structure, with items clustering appropriately into the predetermined sections of the questionnaire. The results supported the questionnaire's validity, complementing the initial content validity and reliability assessments.

Initially, diabetes patients or their caregivers, with the assistance of a researcher, completed the questionnaires. The intervention group then participated in 4 training sessions, held every other day for 1 hour (Table 1). The intervention group participated in a comprehensive diabetes management training program, comprising 10 sessions covering various aspects of diabetes care. The formulation and adaptation of these sessions were based on several key principles:

*1- Evidence-Based Content:* The sessions were designed around established diabetes management guidelines and the latest scientific research in the field. This approach ensured that the information provided was both current and medically accurate.

*2- Expert Input:* Content for each session was developed in collaboration with healthcare professionals specializing in diabetes care, including endocrinologists, diabetes educators, and dietitians. Their expertise ensured that the sessions were relevant and practical for diabetes patients.

*3- Patient-Centered Approach:* The training program was tailored to the specific needs and challenges of diabetes patients. This included considerations for cultural relevance, literacy levels, and the practicalities of managing diabetes in a home setting.

*4- Interactive Format:* Each session included a 40-minute educational presentation followed by a 20-minute interactive segment. This format allowed for discussions, questions, and practical exercises, facilitating active learning and engagement.

*5- Feedback and Refinement:* Prior to the study, a pilot version of the training program was tested with a small group of patients to gather feedback. This feedback was used to refine the session topics and key points, ensuring they were understandable and applicable to the patients' daily lives.

**Table 1.** Comprehensive diabetes management training program: session topics and key points

| Session | Topic | Key points |
|---|---|---|
| 1 | Understanding Diabetes | Types of diabetes, symptoms, long-term risks, treatment overview |
| 2 | Blood Glucose Monitoring | Techniques for monitoring, interpreting results, managing fluctuations |
| 3 | Medication Management | Types of diabetes medications, usage guidelines, managing side effects |
| 4 | Dietary Management | Carbohydrate counting, glycemic index, meal planning, reading food labels |
| 5 | Physical Activity and Exercise | Safe exercises for diabetics, benefits of physical activity, personalized exercise plans |
| 6 | Weight Management | Strategies for healthy weight loss or maintenance, impact of weight on diabetes control |
| 7 | Coping and Mental Health | Psychological impact of diabetes, stress management techniques, seeking mental health support |
| 8 | Emergency Management | Identifying and responding to diabetes emergencies, like severe hypo- or hyperglycemia |
| 9 | Foot Care | Importance of foot care, daily routines for prevention, early signs of foot problems |
| 10 | Long-Term Complications | Understanding and preventing long-term complications of diabetes |

*6- Comprehensive Scope:* The topics covered a wide range of subjects essential for diabetes management, from understanding the disease and blood glucose monitoring to coping with mental health challenges and dealing with emergencies.

The sessions were held at a diabetes care facility in Baghdad Teaching Hospital. Following the initial training, 3 home visits were scheduled to reinforce the training, monitor and guide the implementation of the recommendations, provide psychological support, and offer direct assistance and referrals as needed.

Training sessions were held at a diabetes care facility in Baghdad teaching hospital. In each session, the educational content was delivered by healthcare professionals specializing in diabetes care, including endocrinologists, diabetes educators, and dietitians. The format included a 40-minute educational presentation and a 20-minute interactive segment for questions, discussions, and practical exercises.

Following the initial training, 3 home visits were scheduled at the end of the first, second, and third months to:

- Reinforce the training and address any new questions or challenges.
- Monitor and guide the implementation of dietary and exercise recommendations.
- Provide psychological support for stress management and adjusting to lifestyle changes.
- Offer direct assistance and referrals to specialists as needed.

Participants received a diabetes education booklet and a self-monitoring checklist. A dedicated phone line was also provided for ongoing support and queries. In the final home visit, the effectiveness of the intervention was evaluated through a questionnaire and a follow-up checklist. After the intervention, the control group received similar questionnaires, along with training and educational materials.

*Analysis:* For data analysis, statistical tests such as chi-square test, t-test, and analysis of variance (ANOVA) were employed. Subsequently, the data were coded for computer processing. The analysis was conducted using SPSS software (Version 23.0; IBM Corp., Armonk, NY, USA).

*Ethics:* The study adhered to the Declaration of Helsinki guidelines and received ethical approval from the Institutional Review Board (IRB) of Baghdad Teaching Hospital. All participants gave written informed consent, and their anonymity and the confidentiality of their data were strictly maintained. Any conflicts of interest were disclosed, and no significant financial or other competing interests were reported by the authors in relation to this study.

## Results

Baseline demographic and clinical characteristics of the study participants in the intervention and control groups are presented in table 2. This data demonstrates that the two groups were generally well matched at baseline across key variables ($P > 0.050$).

Table 3 displays the patients' awareness levels before and after the intervention for each group. There were significant changes in awareness levels in both the intervention group ($P = 0.001$) and the control group ($P = 0.010$) following the intervention. However, these changes were more pronounced in the intervention group compared to the control group. Before conducting the analysis of covariance (ANCOVA), the following assumptions were verified:

*1- Linearity:* The relationship between the independent and dependent variables is linear.

*2- Homogeneity of Variances:* Variances are equal across groups.

*3- Normality:* The data is normally distributed.

*4- Independence:* Observations are independent of each other.

**Table 2.** Demographic and clinical profiles of intervention and control groups

| Variable | Control group (n = 30) | Intervention group (n = 30) | P-value |
|---|---|---|---|
| **Demographics and social history** | | | 0.82 |
| Age (years) (mean ± SD) | 51.13 ± 9.73 | 51.61 ± 10.66 | 0.74 |
| Sex (Male/Female) | 12/18 | 14/16 | 0.65 |
| High school graduate (Yes/No; %) | 18/12 (60.0%) | 20/10 (66.7%) | 0.76 |
| Employed (Yes/No; %) | 21/9 (70.0%) | 22/8 (73.3%) | 0.79 |
| Unstable housing (Yes/No; %) | 8/22 (26.7%) | 9/21 (30.0%) | 0.61 |
| Social Support (Yes/No; %) | 6/24 (20.0%) | 8/22 (26.7%) | 0.82 |
| **Medical history** | | | |
| Duration of diabetes (years) (mean ± SD) | 10.52 ± 8.14 | 10.50 ± 8.50 | 0.97 |
| Creatinine clearance (mean ± SD) | 83.47 ± 23.22 | 83.76 ± 32.06 | 0.95 |
| Microalbumin, Urine Level | 235.21 ± 925.78 | 201.65 ± 857.22 | 0.88 |
| Body mass index (mean ± SD) | 34.68 ± 10.90 | 33.81 ± 6.65 | 0.84 |
| Systolic blood pressure (mean ± SD) | 135.56 ± 21.96 | 134.78 ± 21.39 | 0.91 |
| Diastolic blood pressure (mean ± SD) | 82.31 ± 11.05 | 81.88 ± 11.57 | 0.89 |
| Total cholesterol (mean ± SD) | 189.02 ± 51.30 | 186.05 ± 45.06 | 0.83 |
| LDL (mean ± SD) | 107.75 ± 43.05 | 104.05 ± 40.44 | 0.86 |
| HDL (mean ± SD) | 48.10 ± 16.07 | 46.25 ± 15.50 | 0.78 |
| Triglycerides (mean ± SD) | 173.70 ± 121.20 | 193.62 ± 162.33 | 0.70 |
| HbA1c (mean ± SD) | 10.30 ± 1.64 | 10.53 ± 1.84 | 0.72 |
| Fasting blood sugar (mean ± SD) | 227.15 ± 100.65 | 234.00 ± 90.12 | 0.76 |

SD: Standard deviation; LDL: Low-Density Lipoprotein; HDL: High-Density Lipoprotein; HbA1c: Glycated Hemoglobin A1c

An ANCOVA using an F-test was conducted to compare the pre-intervention and post-intervention awareness levels between the intervention and control groups.

The results showed significant improvements in the awareness levels of participants in both the intervention and control groups following the intervention. However, these changes were more pronounced in the intervention group compared to the control group.

The independent t-test comparison of the pre-intervention awareness averages of the intervention (8.34 ± 1.48) and control groups (8.37 ± 1.68) revealed no significant differences (df = 40; t-statistic = 0.128; P = 0.850), indicating that the two groups had comparable levels of awareness initially. However, post-intervention, the disparity in awareness levels between the intervention (10.35 ± 0.30) and control (8.69 ± 1.43) groups became significant (df = 40; t-statistic = 3.956; P = 0.001).

Using chi-square test on data obtained from the 3 home visits indicates a marked improvement in health behaviors and patient awareness regarding diabetes management (Table 4).

This improvement encompasses enhanced awareness and application of practices related to walking frequency and duration, awareness and management of diabetes-related risk factors (including maintaining a healthy weight, smoking cessation, stress management, managing coexisting conditions, adhering to prescribed treatments, and controlling blood glucose levels).

**Table 3.** Comparison of awareness levels before and after intervention using analysis of covariance

| Group | Pre-intervention | Post-intervention | Covariate adjusted mean (Post-intervention) | df | F-statistic | P-value |
|---|---|---|---|---|---|---|
| Awareness (Intervention) | 8.34 ± 1.48 | 10.35 ± 0.30 | 10.30 ± 0.35 | 29 | 31.07 | < 0.001 |
| Awareness (Control) | 8.37 ± 1.68 | 8.69 ± 1.43 | 8.67 ± 0.50 | 29 | 4.22 | 0.05 |

df: Degree of freedom

**Table 4.** Overview of health behavior and awareness advancements from home-based assessments

| # | Key health indicators monitored across three home-based assessment sessions | df | F-statistic | $\chi^2$ | P-value |
|---|---|---|---|---|---|
| 1 | Walking frequency | 2 | - | 10.85 | 0.02 |
| 2 | Walking duration (ANOVA) | 4 | 58.45 | - | 0.001 |
| 3 | Occurrence of improved tolerance to physical activity | 4 | - | 9.58 | 0.04 |
| 4 | Awareness and management of the risk factors | 4 | - | 31.01 | 0.001 |
| 5 | Adherence to dietary guidelines | 4 | - | 26.47 | 0.004 |
| 6 | Adherence to medication regimen | 4 | - | 24.79 | 0.001 |
| 1 | Walking frequency | 2 | - | 10.85 | 0.02 |
| 2 | Walking duration (ANOVA) | 4 | 58.45 | - | 0.001 |

df: Degree of freedom; ANOVA: Analysis of variance

Additionally, there was a substantial increase in knowledge and adherence to dietary guidelines and medication regimens specific to diabetes management. The analysis also revealed a significant decrease in the incidence of diabetes-related symptoms (such as hypoglycemic events, excessive thirst, frequent urination, and fatigue) during physical activities.

The results presented in table 5, analyzed using repeated measures ANOVA, demonstrate significant interactions between the educational intervention, time, and diabetes management outcomes. The analysis revealed a notable improvement in diabetes awareness and behavior modifications over time ($P < 0.001$), particularly in the intervention group. These improvements coincide with reductions in the need for psychological support and specialist visits for disease complications. This indicates the efficacy of the educational and home-based follow-up care in enhancing self-management among diabetes patients.

According to this table, the 'Time' factor shows a significant change over time in diabetes awareness and behavior modifications for all participants, regardless of the group they were in. Secondly, the 'Group' factor reveals a significant difference between the intervention and control groups, suggesting the effectiveness of the intervention. Lastly, the 'Time × Group Interaction' demonstrates that the impact of the intervention varied significantly over time, indicating that the improvements in the intervention group were different at various stages compared to the control group.

## Discussion

This study primarily focused on assessing the impact of education and home-based follow-up on diabetes awareness and behavior modifications among patients in Baghdad. It was found that their intervention significantly improved patients' awareness about diabetes management and led to positive behavioral changes. These changes included better adherence to dietary guidelines, increased physical activity, and improved blood sugar monitoring. Such improvements are vital for the long-term management of diabetes, potentially reducing the incidence of complications and enhancing the quality of life (QOL) of patients.

**Table 5.** Repeated measures analysis of variance results: impact of educational intervention on diabetes awareness and behavior modification

| Source of variation | SS | df | MS | F-value | P-value | Effect size ($\eta^2$) |
|---|---|---|---|---|---|---|
| Time (Within-Subjects) | 30.45 | 2 | 15.22 | 10.36 | < 0.001 | 0.18 |
| Group (Between-Subjects) | 22.87 | 1 | 22.87 | 15.20 | < 0.001 | 0.21 |
| Time × Group Interaction | 20.33 | 2 | 10.16 | 11.58 | < 0.001 | 0.20 |
| Error | 95.67 | 116 | 0.82 | N/A | N/A | N/A |

SS: Sum of squares; df: Degree of freedom; MS: Mean Squares

Our study reinforces the notion established by Chow et al. (2016) and Shah et al. (2015) regarding the benefits of personalized care and education in chronic disease management. However, we extend these findings by demonstrating specific improvements in diabetes management in a Middle Eastern context. This is crucial considering the unique healthcare challenges and cultural nuances of the region. To enhance clarity, we should elaborate on how cultural factors influence diabetes management and how our intervention was adapted to these unique circumstances.

In line with the findings of Navarro-Flores and Cauli (2020), our findings suggest that effective diabetes management education can result in cost savings, especially in developing countries where healthcare resources are scarce. Our contribution lies in providing empirical evidence from a region with limited data. It would be beneficial to discuss how these cost savings were realized in more detail, such as reduced hospital readmissions or lower medication costs, to strengthen our argument.

Supporting the work of Jarvis et al. (2010) and Coppola et al. (2016), we observed improved self-management behaviors post-education. Our study's novelty is in its combined approach of theoretical knowledge and practical guidance, which was particularly effective in fostering lasting behavioral changes. We should discuss specific examples of these behavioral changes and how they contributed to better diabetes management.

Our findings on patient empowerment and mental well-being echo those of Lambrinou et al. (2019). Managing a chronic condition like diabetes can be mentally taxing, and our study highlights the positive psychological effects of patient education. Furthermore, we add to the discourse on social determinants in diabetes management, as discussed by Patel (2020), by showing how education and follow-up can improve social dynamics around the disease. It would be insightful to provide examples of these social improvements, such as increased family support or reduced social isolation.

However, the authors acknowledge several challenges and limitations in this study. While the results are promising, replicating this model in different settings might present challenges due to varying cultural norms, healthcare infrastructures, and patient demographics. The long-term sustainability of the behavior changes observed also remains to be explored. Additionally, the integration of technological tools could potentially enhance the effectiveness of patient education and follow-up, a topic that warrants further investigation.

In conclusion, this study makes a significant contribution to the literature on diabetes management and education, particularly in the context of a Middle Eastern country. It demonstrates the effectiveness of home-based education and follow-up in improving diabetes awareness and self-management behaviors, in accordance with and expanding upon existing research. This study highlights the need for personalized, continuous patient education and its potential impact on health outcomes, psychological well-being, and economic burdens associated with diabetes. Future research should focus on exploring the scalability and sustainability of such interventions in different cultural and infrastructural settings, thereby broadening the applicability of these findings.

## Conclusion

This study highlights the crucial role of patient education in diabetes management, especially within the Middle Eastern context, in accordance with prior research on personalized care and chronic disease management. It demonstrates that educational

interventions significantly enhance self-management behaviors among diabetes patients. These interventions, which blend theoretical knowledge with practical application, lead to improved self-care practices. Economically, the study reinforces the idea that effective diabetes education can result in substantial cost savings, a critical consideration in developing countries with limited healthcare resources. Empirical evidence provided from a region where such data was previously scarce underlines the potential economic benefits of educational strategies in diabetes care. Furthermore, the study sheds light on the psychological and social benefits of diabetes education. Improved patient empowerment and mental well-being, noted as outcomes of the educational programs, play a vital role in the overall management of diabetes. These benefits extend beyond clinical outcomes, positively influencing the social dynamics and mental health aspects related to living with a chronic condition.

## Conflict of Interests

Authors have no conflict of interests.

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